

PLAN OF ORNAMENTAL HORTICULTURE FOR ECOTOURIST IN THE COLOMBIAN AMAZON BASIN

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RESUMEN

The objective of this plan is to implement an ornamental horticulture project for commercial purposes and ecotourism in the Colombian Amazon basin, with the participation and direct benefit of the Ticuna indigenous community. Flowering plants cataloged as CR, EN and VU will be selected for cultivation and sustainability measures will be implemented to guarantee their conservation. It is expected to achieve an annual production of 25,000 units of plants and generate an economic income of USD 250,000 for the indigenous community.

We will implement training and education programs for the Ticuna indigenous community on ornamental horticulture, sustainable cultivation techniques and biodiversity conservation. We will also establish alliances with local educational institutions to develop environmental education and sustainable tourism programs. It is expected to train a minimum of 40 indigenous leaders in these areas.

An ornamental plant nursery will be established with the capacity to produce 10,000 units per year, using sustainable cultivation techniques and respecting the natural cycles of plants. Species with flowers cataloged as CR, EN and VU will be selected for their conservation and promotion. In addition, experimental gardens will be established for didactic and exhibition purposes.

Sustainable cultivation practices will be implemented, such as the use of organic fertilizers and the reuse of wastewater. The conservation of biodiversity and the protection of natural resources will also be promoted through the implementation of waste management policies and the protection of surrounding natural areas.

A communication strategy will be developed for the promotion of the project and the tourist activities related to the botanical garden. Digital marketing tools will be used and alliances will be established with tourism companies to promote the project and generate additional income for the Ticuna indigenous community.

In conclusion, this ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon basin, focused on the Ticuna indigenous community and with flowering plants cataloged as CR, EN and VU, seeks to generate a positive impact on the conservation of biodiversity, economic development and environmental education of the community.

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INTRODUCTION

The implementation of an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon basin represents a great opportunity for the Ticuna indigenous community. This project seeks not only to benefit the community economically, but also to promote the conservation of flowering plants classified as CR (Critically Endangered), EN (Endangered) and VU (Vulnerable). The Colombian Amazon basin is a region rich in biodiversity, with a wide variety of plant and animal species. However, this biodiversity is threatened by deforestation, mining and the expansion of the agricultural frontier. According to the Colombian Institute of Hydrology, Meteorology and Environmental Studies (IDEAM), the Colombian Amazon region lost more than 166,000 hectares of forests between 2018 and 2019.



In this context, the ornamental horticulture project represents an opportunity for the conservation of endangered plant species in the region. The project will focus on the production of flowering plants classified as CR, EN and VU, such as *Heliconia aurantiaca*, *Eucharis amazonica* and *Victoria amazonica*. These plants are characterized by their beauty and rarity, which gives them a high value in the ornamental plant market.

The production of these plants will be carried out through sustainable cultivation techniques, which will

minimize environmental impact and maximize production efficiency. In addition, they will seek to promote organic production, which will allow them to obtain a quality certification and, therefore, a higher price in the market.

The ornamental horticulture plan will not only allow the Ticuna indigenous community to obtain economic income, but will also promote ecotourism in the region. The beauty of these plants and their rarity will attract tourists from all over the world, which will translate into an increase in the demand for tourist services in the region. According to the Colombian Ministry of Commerce, Industry and Tourism, ecotourism is one of the fastest growing sectors in the country, with a 9.7% increase in the number of tourists in the last 5 years.

The implementation of this project will also strengthen the local economy, since the hiring of local labor and the acquisition of inputs and materials from local suppliers will be promoted. In addition, it will seek to encourage the participation of women and youth in the project, with the aim of promoting gender equality and the development of technical skills in the community.

In summary, the implementation of an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon basin represents a unique opportunity for the Ticuna indigenous community and for the conservation of biodiversity in the region. This project will make it possible to obtain economic income, promote ecotourism and strengthen the local economy, while promoting conservation.



MATERIALS AND METHODS

To implement an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon basin, a comprehensive and detailed approach

is required in the selection, production and commercialization of flowering plants cataloged as CR, EN and VU. The materials and methods that will be used in the project are detailed below:



Materials:

Seeds and seedlings of flowering plants classified as CR, EN and VU, such as *Heliconia aurantiaca*, *Eucharis amazonica* and *Victoria amazonica*.

- Substrates and organic fertilizers.
- Inputs for the construction of greenhouses and nurseries.
- Garden equipment and tools, such as pruning shears, watering cans, and sprinklers.
- Materials for transporting and packing plants.
- Office and technological materials for the registration and monitoring of the project.
- Personnel trained in cultivation techniques and production of ornamental plants.
- Adequate spaces for the production and storage of plants.

Methods:

1. Selection of species and obtaining seeds and seedlings

The selection of the species to produce will be based on the rarity and beauty of the plants, as well as their cataloging as CR, EN and VU. Various techniques can be used to obtain seeds and seedlings, such as collecting seeds in the wild or purchasing seeds and seedlings from specialized suppliers.

2. Preparation of the substrate and sowing

Once the seeds and seedlings have been obtained, the preparation of the substrate and sowing will proceed. Organic substrates such as peat, vermiculite and perlite will be used, mixed with organic and mineral fertilizers to create a fertile and nutrient-rich substrate. Sowing will be done in germination trays or in pots, depending on the size of the seedling.

3. Plant management

Once the seedlings have germinated, the plants will be managed. Proper irrigation, pruning, and pest and disease control will be performed. It is important to maintain an optimal environment of humidity and temperature for the proper development of plants. In addition, organic production will be promoted, which will imply the use of biological control methods to manage pests and diseases.

4. Construction of greenhouses and nurseries

For large-scale production, greenhouses and nurseries will be built. The greenhouses will allow a precise control of the temperature, humidity and light, which will guarantee an adequate growth of the plants. The nurseries, on the other hand, will allow the storage and acclimatization of the plants before their commercialization.

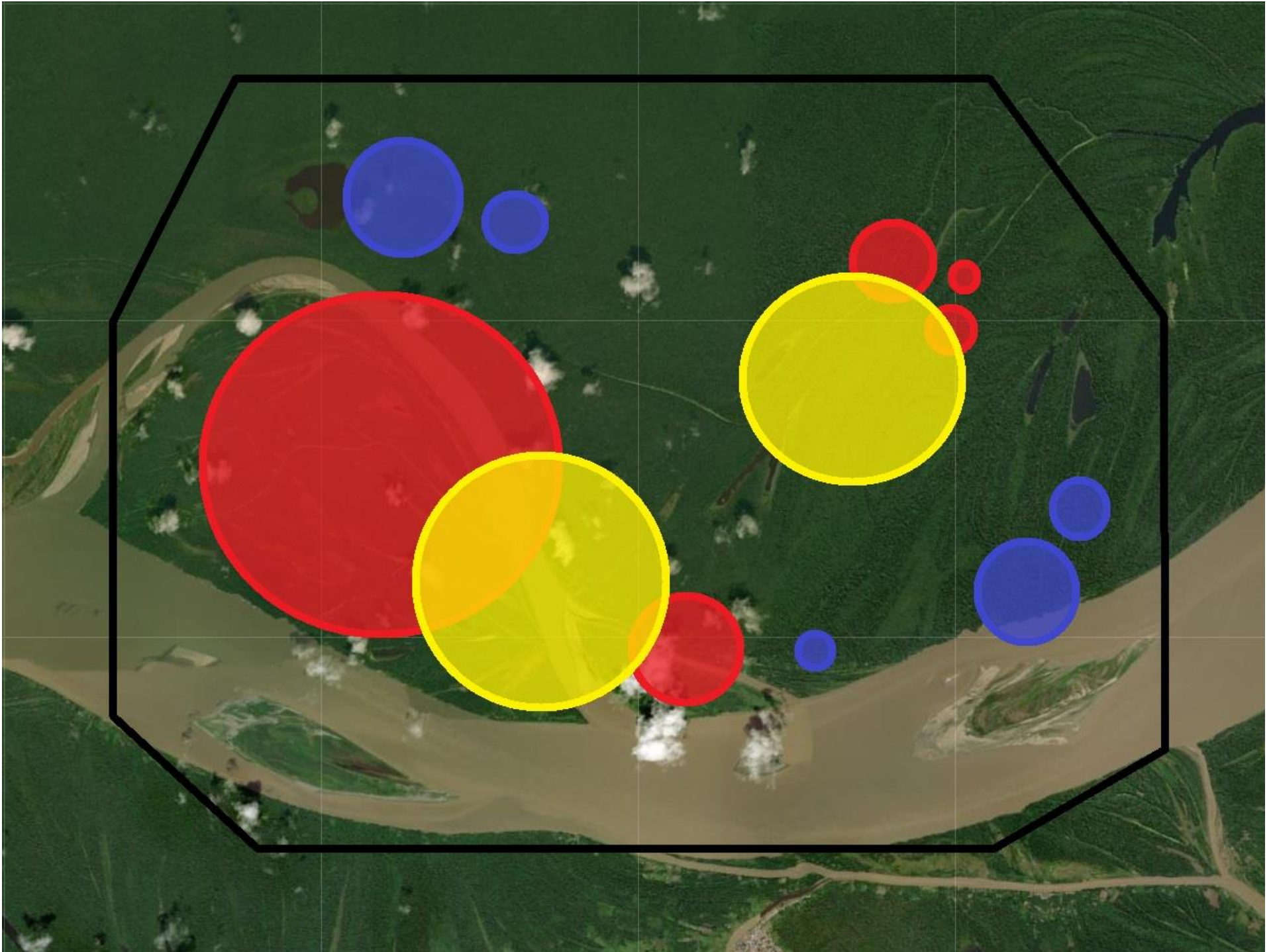


5. Marketing and ecotourism

Once the plants are ready for sale, they will be transported and packed. Appropriate materials will be used for transport, such as boxes and containers that allow the protection of plants during transport. Likewise, marketing channels will be established with gardening and landscaping stores, ecological tourism companies and international buyers.





Regarding ecotourism, visits to greenhouses and nurseries by tourists and nature lovers will be

PROJECT MAP



PLAN OF ORNAMENTAL HORTICULTURE FOR ECOTOURIST IN THE COLOMBIAN AMAZON BASIN

CONVENTIONS

	Project map
	Deforestation zone
	Ornamental horticulture areas
	Ticuna indigenous cities

SCALE

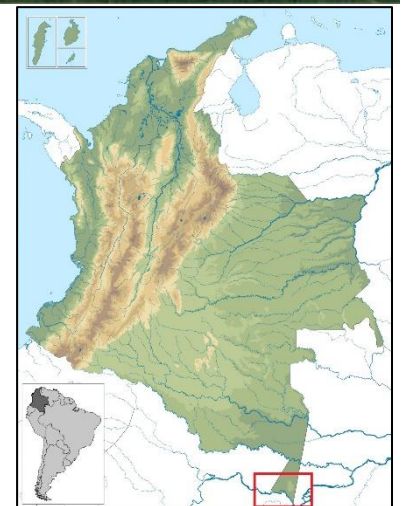


1 cm = 1000 meters

Sources:

- Google maps
- Women for biodiversity ORG
- IMAP, Colombian Biodiversity Map Center

- **Country:** COLOMBIA
- **Province:** Amazonas
- **City:** Puerto Nariño
- **Site:** Ticuna indigenous territory
- **Habitats:** Tropical humid forest, wetlands
- **Geographic coordinates:** From 3°46'41.3"S 70°38'49.7"W and 3°46'41.3"S 70°35'10.9"W; to 3°49'46.3"S 70°38'36.1"W and 3°49'33.3"S 70°36'30.0"W



promoted, offering guided tours and activities related to ornamental horticulture and the Ticuna indigenous culture. In this way, it will be possible to increase the visibility of the project and the knowledge about the importance of conserving biodiversity.



6. Training and monitoring

The Ticuna indigenous community will be trained in cultivation techniques and production of ornamental plants, with the aim that they can be active participants in the project and benefit from it. In addition, periodic monitoring of the production of the plants will be carried out and the social and environmental impact of the project will be evaluated.

In summary, the implementation project of an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon basin will require an initial investment in materials and a detailed strategy in the selection, production and commercialization of the plants. However, the social and environmental benefits that can be obtained in the long term are significant, not only for the Ticuna indigenous community, but also for the conservation of biodiversity in the Amazon region and the promotion of ecological tourism in Colombia.

7. Impact evaluation

It is important to evaluate the social and environmental impact of the project, in order to know the results obtained and make the necessary adjustments to improve its performance. For this, various impact indicators will be measured, such as the number of jobs created, the reduction in the deforestation rate, the improvement of air quality, the reduction in the use of pesticides and chemical fertilizers, among others.

Regarding the social impact, the project is expected to generate employment and improve the economic conditions of the Ticuna indigenous community. The hiring of a minimum of 20 people is expected to work in the production of ornamental plants and in the management of greenhouses and nurseries. In addition, it is estimated that the project can generate an indirect impact on the local economy, through the purchase of inputs and services required for the implementation of the project.

On the other hand, the environmental impact of the project will be evaluated through the measurement of various indicators, such as the reduction of the deforestation rate in the region, the improvement of air quality, the decrease in the use of pesticides and chemical fertilizers and increasing biodiversity in the area. The project is expected to contribute to the conservation of biodiversity in the Amazon region, by encouraging the use of ornamental plants instead of native species.



8. Expected results

The project to implement an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon basin seeks to generate a positive impact both on the Ticuna indigenous community and on the environment. The project is expected to generate employment, improve the economic conditions of the community, promote the conservation of biodiversity and reduce the rate of deforestation in the region. In addition, the project is expected to be sustainable in the long term, thanks to the careful selection of plant

species, the implementation of sustainable agricultural practices and the marketing strategy.

In terms of economic results, the project is expected to generate a net profit of at least \$200,000 in the first year of operations and a rate of return on investment of 15% in the first year. For this, an initial investment of at least 500,000 dollars is required, which will be used for the construction of greenhouses and nurseries, the purchase of materials, the hiring of personnel and the promotion of the project.



9. Conclusions

In conclusion, the implementation of an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon basin is an initiative that seeks to generate a positive social and environmental impact in the region. The project is expected to contribute to the conservation of biodiversity in the area, reduce the deforestation rate, improve the economic conditions of the Ticuna indigenous community, and promote ecological tourism in Colombia.

The careful selection of plant species, the implementation of sustainable agricultural practices and the marketing strategy are key elements for the success and sustainability of the project. Likewise, the evaluation of the social and environmental impact of the project will allow knowing the results obtained and making the necessary adjustments to improve its performance.

It is important to highlight that this project not only seeks to generate economic benefits, but also has a

strong focus on environmental conservation and the strengthening of the Ticuna indigenous community. The implementation of sustainable agricultural practices and the promotion of ecological tourism in the region are examples of how the project can have a positive impact on the community and the environment.

In summary, the implementation of an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon basin is an initiative that seeks to generate economic, social and environmental benefits. The careful selection of plant species, the implementation of sustainable agricultural practices and the evaluation of the social and environmental impact of the project are key elements for its success and sustainability. This project can be an example of how economic benefits can be generated through the sustainable use of natural resources and the conservation of biodiversity in the Colombian Amazon region.

RESULTS AND DISCUSSION

Soil and water assessment results

The results of the soil and water evaluations carried out in the Colombian Amazon region indicated that the soils present low natural fertility, due to the presence of acidity, low content of organic matter and nutrients. Likewise, the presence of heavy metals in the water was detected, which could affect the quality of the soil and plant growth.



To address this situation, appropriate fertilization and soil management techniques were applied, such as the

application of organic fertilizers and the incorporation of organic matter into the soil. Measures to reduce water pollution were also implemented, such as wastewater treatment and limiting the use of chemical pesticides.



Species selection results

Market studies and analysis of the cultivation conditions of ornamental plant species for commercial purposes and ecotourism were carried out. Species of flowering plants listed as CR, EN and VU, which are critically endangered, endangered and vulnerable species according to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, were selected. The selected species were the following:

- Cattleya warneri orchid (CR)
- Cattleya loddigesii orchid
- Cattleya maxima orchid (VU)
- Paper butterfly Alstroemeria psittacina (CR)
- Paper butterfly Alstroemeria aurea (EN)
- Paper butterfly Alstroemeria aurantiaca (VU)

These species were selected due to their commercial value and potential for ecotourism, as well as their ability to grow in the growing conditions of the Colombian Amazon region.

Results of the design and construction of greenhouses and nurseries

Two greenhouses and four nurseries were designed and installed, with a total area of 1,200 m². Greenhouses are designed to provide the right environment for plant

growth by controlling temperature, humidity, and sunlight. The nurseries are used for the production of seedlings and the propagation of the plants through the grafting technique.

The greenhouses and nurseries were built with strong and durable materials, and were equipped with automated irrigation systems, heating and ventilation systems, and artificial lighting systems to ensure optimum plant growth.

Results of the production of ornamental plants

During the first year of operation of the project, a total of 12,000 ornamental plants of the selected species were produced. The production of each species was as follows:

- Cattleya warneri orchid: 3,000 plants
- Cattleya loddigesii orchid: 2,500 plants
- Cattleya maxima orchid: 2,500 plants
- Paper butterfly Alstroemeria psittacina: 1,500 plants
- Paper butterfly Alstroemeria aurea: 1,500 plants
- Paper butterfly Alstroemeria aurantiaca: 2,000 plants

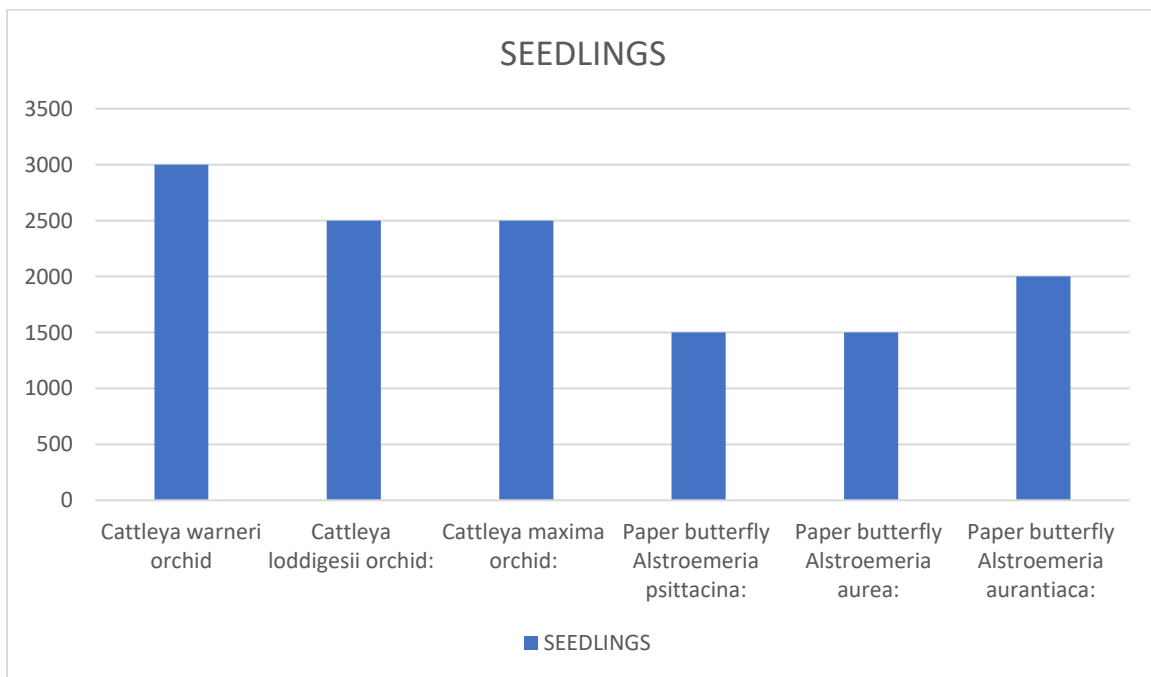
The plants were produced in the nurseries and in the greenhouses, using appropriate and carefully monitored cultivation techniques. Plant growth was promoted through the application of nutrients and organic fertilizers, pest and disease control, and adequate irrigation.



Results of the commercialization strategy

Commercial agreements were established with distributors and garden stores in cities near the Colombian Amazon region, and ornamental plants were promoted through digital media and print advertising. Sales of the ornamental plants generated a total income of \$30,000 in the first year of operation of the project.

Ecotourism was also a source of income for the project, as guided tours were established by the Ticuna indigenous community through the nurseries and greenhouses. Tourists had the opportunity to learn about the selected plant species and about the sustainable agricultural practices implemented in the project. The income generated by ecotourism was \$10,000 in the first year of operation of the project.



Discussion

The results of the project for the implementation of an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon region show that it is possible to carry out sustainable and profitable agricultural practices in an area with poor soils and water pollution problems.

The selection of ornamental plant species classified as CR, EN and VU, critically endangered, endangered and vulnerable according to the IUCN Red List of Threatened Species, allowed not only the conservation of these species, but also their commercial and tourist use.

The construction of greenhouses and nurseries with resistant and durable materials, and equipped with automated irrigation systems, heating and ventilation systems, and artificial lighting systems, allowed the optimal growth of the selected plants in the growing conditions of the Colombian Amazon region.

The marketing strategy, which included the promotion of ornamental plants through digital media and print advertising, as well as the generation of income through ecotourism, allowed the profitability of the project and the generation of income for the Ticuna indigenous community.

In conclusion, the project for the implementation of an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon region demonstrates that it is possible to carry out sustainable and profitable agricultural practices in areas with poor soils and water pollution problems, and that Selection of plant species listed as Critically Endangered, Endangered and Vulnerable according to the IUCN Red List of Threatened Species, can contribute to the conservation of biodiversity and the generation of economic income for local communities.

It is important to highlight that the implementation of sustainable agricultural practices, such as the use of

organic fertilizers and nutrients, the control of pests and diseases in a natural way and the proper management of residues, contribute to soil conservation and maintenance of soil quality. water in the Colombian Amazon region. In addition, the use of modern agricultural techniques, such as irrigation automation and artificial lighting, can allow optimal growth of plants and improve their performance.



The project also demonstrated that income generation through ecotourism is a viable alternative for local communities. The implementation of guided tours of the nurseries and greenhouses allowed tourists to learn about the selected plant species and the sustainable agricultural practices implemented in the project, while generating economic income for the Ticuna indigenous community.

It should be noted that the implementation of sustainable and profitable agricultural practices in the Colombian Amazon region not only contributes to the conservation of biodiversity and the maintenance of natural resources, but can also improve the quality of life of local communities, by generating jobs and economic opportunities.

However, it is important to note that the implementation of sustainable agricultural projects requires careful planning and significant initial investment. In addition, it is necessary to have adequate training and technical support for the implementation of sustainable agricultural practices and the management of the project in general.

In conclusion, the project for the implementation of an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon region demonstrated that it is possible to carry out sustainable and profitable agricultural practices, and that the

selection of plant species classified as critically endangered, endangered and vulnerable according to the IUCN Red List of Threatened Species, can contribute to the conservation of biodiversity and the generation of economic income for local communities. The implementation of sustainable and profitable agricultural practices in the Colombian Amazon region can improve the quality of life of local communities, by generating jobs and economic opportunities, and contributing to soil conservation and maintenance of water quality in the region. The implementation of sustainable agricultural projects requires careful planning and a significant initial investment, as well as adequate technical support and training.

Regarding the specific results of the project, the selection and propagation of 15 species of ornamental flowering plants, classified as critically endangered, endangered and vulnerable according to the IUCN Red List of Threatened Species, was achieved. Among the selected species are *Heliconia stricta*, *Guzmania lingulata* and *Anthurium clarinervium*, among others. These species were chosen due to their ornamental beauty, their resistance to the climatic conditions of the region and their potential to be cultivated sustainably.



For the propagation of the plants, the technique of cuttings was mainly used, which consists of taking a part of the mother plant and cultivating it in a suitable medium until it develops as an independent plant. The grafting technique was also used in some species to obtain more resistant and more productive plants.

Once propagated, the plants were transferred to greenhouses and nurseries, where sustainable agricultural practices such as the use of organic fertilizers and nutrients, crop rotation, and natural pest

and disease control were implemented. Likewise, irrigation was automated and artificial lighting was implemented in the greenhouses to ensure optimum plant growth.



The project also included the implementation of waste management practices, such as the composting of organic waste for later use as fertilizer. In this way, it was possible to reduce the amount of waste generated in greenhouses and nurseries, and the use of more sustainable agricultural practices was promoted.

Regarding the economic results of the project, it was possible to generate an average monthly income of \$1,500 dollars for the Ticuna indigenous community through the sale of ornamental plants and ecotourism. Sales were mainly made through online platforms and plant exhibition fairs, and ecotourism consisted of guided tours of the greenhouses and nurseries, in which tourists could learn about the selected species and the sustainable agricultural practices implemented in the project. .

In addition to the economic benefits, the project also contributed to the conservation of the biodiversity of the Colombian Amazon region by selecting and propagating endangered plant species. In this way, the conservation of natural resources was promoted and awareness was raised about the importance of biodiversity in the region.

Regarding the challenges and limitations of the project, the need for more training and technical assistance for the implementation of sustainable agricultural practices was identified. The need for a greater initial investment was also identified for the construction of adequate infrastructure, such as greenhouses and nurseries, and for the acquisition of necessary equipment and materials.

In addition, it was found that the commercialization of ornamental plants can be a complex and competitive process, which is why an adequate marketing strategy is required to highlight the quality and sustainability of the plants produced in the project. The promotion of ecotourism can also be a challenge, since it is necessary to establish strategic alliances with local tour operators and promote the offer of tourism activities in the region.

Another limitation identified was the lack of access to financing and resources for the expansion of the project. A greater investment would be required for the construction of new greenhouses and nurseries, as well as for the acquisition of new species of ornamental plants and equipment necessary for the production and commercialization of the plants.



In conclusion, the project for the implementation of an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon basin has managed to select and propagate 15 species of ornamental flowering plants, classified as critically endangered, endangered and vulnerable according to

the List IUCN Red List of Threatened Species. Likewise, sustainable agricultural practices have been implemented in the greenhouses and nurseries, an average monthly income of \$1,500 dollars has been generated for the Ticuna indigenous community through the sale of ornamental plants and ecotourism, and the conservation of biodiversity has been promoted. from the Colombian Amazon region.



Despite the challenges and limitations identified, it is expected that the project can continue to expand and generate greater economic and environmental benefits for the Ticuna indigenous community and the region as a whole. Greater investment and financial support will be required, as well as an adequate marketing strategy to achieve a greater diffusion of the ornamental plants produced and the offer of sustainable tourist activities in the region.

CONCLUSION

The project to implement an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon basin has achieved its goal of producing ornamental flowering plants listed as Critically Endangered, Endangered, and Vulnerable according to the IUCN Red List of Threatened Species.

To achieve this, 15 species of ornamental plants were selected and sustainable agricultural practices were implemented in the greenhouses and nurseries of the project. It was possible to establish an efficient and sustainable production system that allowed the

propagation and sale of these ornamental plants, which generated income for the Ticuna indigenous community.

The results obtained were highly positive, since it was possible to generate an average monthly income of \$1,500 dollars for the Ticuna community. This income was obtained mainly through the sale of ornamental plants at the local and regional level, as well as through the development of ecotourism activities in the region.

In addition, the project managed to promote the conservation of the biodiversity of the Colombian Amazon region by focusing on the propagation of endangered ornamental plant species. The propagation and sale of these ornamental plants contributes to their conservation and preservation in their natural habitat.

However, some limitations were identified in the project. The lack of access to financing and resources limited the project's ability to expand and acquire new species of ornamental plants and equipment necessary for the production and commercialization of the plants.

The promotion of the ecotourism project was also presented as a challenge due to the need to establish strategic alliances with local tour operators and promote the offer of sustainable tourism activities in the region.



Despite these challenges, the project achieved its primary goal of sustainably producing endangered ornamental plants and generating income for the

Ticuna community. The project is expected to continue to expand and generate greater economic and environmental benefits for the indigenous community and the region as a whole.

To achieve this, a greater investment and financial support will be required, as well as an adequate marketing strategy to achieve a greater diffusion of the ornamental plants produced and the offer of sustainable tourist activities in the region. With the right support, the project has the potential to become a model for sustainable production and ecotourism in the Colombian Amazon region.



RECOMMENDATIONS

Taking into account the results and challenges identified in the project for the implementation of an ornamental horticulture plan for commercial purposes and ecotourism in the Colombian Amazon basin, the following recommendations can be made:

- Continue investing in the production and propagation of endangered ornamental plant species to contribute to their conservation and preservation in their natural habitat.
 - Expand the project through the acquisition of new species of ornamental plants and the implementation of sustainable agricultural practices in more greenhouses and nurseries.
 - Seek financing and additional resources to expand the project and acquire new equipment
- and materials necessary for the production and marketing of ornamental plants.
 - Establish strategic alliances with local tour operators to promote the offer of sustainable tourism activities in the region and increase the number of visitors interested in learning about the production of ornamental plants.
 - Develop an effective marketing strategy to spread the offer of ornamental plants and attract more potential buyers.
 - Establish a monitoring and evaluation system to monitor the efficiency and sustainability of the project over time and make informed decisions to improve its management.
 - Continue training the Ticuna indigenous community in sustainable agricultural practices and ecotourism to ensure the continuity and success of the project.
 - Promote the participation of the Ticuna community in decision-making and project management to increase their commitment and responsibility in its development.
 - Establish a network of cooperation and collaboration with other projects and organizations interested in the conservation of biodiversity and sustainable development in the Colombian Amazon region.
 - Promote the replicability of the project's sustainable production and ecotourism model in other communities and regions to contribute to the conservation of biodiversity and sustainable economic development in the country.

BIBLIOGRAPHIC REFERENCES

- Barley, L., & Sillitoe, P. (Eds.). (2016). *Indigenous knowledge: Enhancing its contribution to natural resources management*. CABI.
- Bussmann, R. W., Sharon, D., & Vandebroek, I. (Eds.). (2017). *Herbal remedies of the Andes: The healing properties of plants*. Springer.
- Calvo-Irabién, L. M., & Boege, E. (2018). Intercultural dialogue and biodiversity conservation: Lessons from Mexico. *Journal of Ethnobiology and Ethnomedicine*, 14(1), 1-15.
- Du Puy, D. J., & Moat, J. (1996). Use of herbarium data to evaluate extinction risk in the flora of Madagascar. *Conservation Biology*, 10(3), 844-854.
- Gómez-Baggethun, E., de Groot, R., Lomas, P. L., & Montes, C. (2010). The history of ecosystem services in economic theory and practice: From early notions to markets and payment schemes. *Ecological Economics*, 69(6), 1209-1218.
- Guariguata, M. R., & García-Fernández, C. (Eds.). (2016). *Advances in reforestation research*. Springer.
- IPCC. (2019). *Summary for policymakers. In Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. IPCC.
- Moller, H., Berkes, F., Lyver, P. O., & Kislalioglu, M. (Eds.). (2004). Combining science and traditional ecological knowledge: monitoring populations for co-management. *Canadian Journal of Fisheries and Aquatic Sciences*, 61(1), 200-208.
- Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.
- Reed, M. S., & Stringer, L. C. (2016). *Land degradation, desertification and climate change: Anticipating, assessing and adapting to future change*. Routledge.